Introduction

Hypertension, high blood pressure, is defined by a **systolic blood pressure >140** or **diastolic blood pressure > 90** mmHg. Hypertension itself is a silent disease; the patient doesn't feel it. But it's a risk factor for atherosclerotic diseases: peripheral vascular disease, stroke, heart attack. The goal is to modify this risk factor, to gain control of the disease, and to prevent development of heart disease.

Diagnosis

Hypertension is diagnosed with **two separate blood pressures** taken at **two separate office visits** with the systolic or diastolic blood pressure being elevated. The best form of diagnosis is ambulatory blood pressure monitoring, though since the vitals are taken at each office visit, it's often diagnosed in clinic. According to JNC-8, there is no more staging of hypertension, though that discussion is still included at the end of this topic with an explanation for why it is useful.

Hypertensive urgency is any blood pressure > 180 systolic or > 110 diastolic without evidence of end organ damage. This is seen in the clinic, urgent care, or ED. It's managed with oral medications.

Hypertensive emergency is any blood pressure >180 systolic or > 110 diastolic with evidence of end organ damage. It's treated with intravenous infusions to control MAP. The goal is to use intravenous nitrates or calcium-channel blockers to get the MAP ↓ 25% in the first 2-6 hours, then to normal ranges with oral medications in 24 hours.

I still teach the 20, 10 symptom rule, Stage I, Stage II, Urgency, and Emergency because it suggests how many medications you'll need to gain control, plus JNC-7 focused on comorbid conditions. This is included to the right.

JNC-8 Management

JNC-8 has made the management of hypertension quite simple. While hypertension often exists with comorbid conditions that require stricter blood pressure goals, JNC-8 has clarified the management of hypertension.

The **goal** for age ≥ 60 is 150/90, and for everyone else 140/90.

To treat, use your choice of **CCB** (amlodipine), **thiazide** (HCTZ) or **ACE-i**. If they can't tolerate an ACE, an ARB can also be used. It doesn't matter which is chosen or in which order.

Except: **old people** (> 75) and **African Americans** don't get an ACE-i / ARB to start.

Except: **CKD** (even if you are old or AA) patients get an ACE-i / ARB as the first medication.

Stage	***SYS***	***DIA***	***Initial Tx***
Normal	120	80	Lifestyle and Diet
Pre-HTN			Lifestyle and Diet
Stage I	140	90	Thiazide > ACE > CCB
Stage II	160	100	Comorbid Specific
Urgency	180	110	PO Meds (Hydralazine)
Emergency	Alarm Sxs		IV Meds (Labetalol)

Start with Normal. Add 20 to systolic, 10 to diastolic to reach the minimum BP required for the next stage. It is an "OR" statement—if either the SYS or DIA is in a stage, you call it the highest qualified stage.

Dz	***Medications***
CAD	BB + ACE . . . ISMN, CCB
CHF	BB + ACE . . . ISDN + Hydralazine, Spironolactone
CVA	ACE-i
DM	ACE-i
CKD	ACE-i . . . Thiazides don't work after Cr > 1.5

Comorbid conditions often dictate the medications chosen, and may directly oppose JNC-8 recommendations (CAD and CHF in particular).

JNC-8 Recommendations in a Nutshell

1. **≥60** + **No Dz** = 150 / 90
2. Everyone else = 140 / 90
3. CCB, Thiazide, ACE/ARB
4. Old (>75) or AA = No ACE-i
5. CKD → ACE/ARB (overrides #4)
6. Don't use β-blockers for hypertension

Medications

You should learn the indications, contraindications, and side effects of each of the medications. This information is included to the right.

Major highlights that are worth remembering:

ACE-i's can induce angioedema. If they do, the person must never again be on an ACE. ARB is ok.

ACE-i's can induce a chronic dry cough. Switch to an ARB if this happens. Both ACEs and ARBs cause hyperkalemia.

β-blockers reduce the heart rate. While it's considered a side effect, it's often intended (as in CHF and CAD) to reduce the workload of the heart.

Spironolactone causes gynecomastia and hyperkalemia. If the gynecomastia becomes a problem, switch to eplerenone.

Class	*Side effect*	*Indication*
CCB	Peripheral Edema	JNC-8, Angina
ACE	↑ K, Cough, Angioedema	JNC 8 AA X Old X CKD Y
ARB	↑K	JNC-8 ACE-intolerance
Thiazide	↓K	JNC-8 Stop if GFR ↓
Loop	↓K	Renal Failure CHF II-IV
β-blocker	↓HR	CAD, CHF
Art Dilators	Reflex Tachy	CHF
Venodilator	Sildenafil unsafe drop in BP	CHF
Aldo Antagonists	↑K, Gynecomastia	CHF
Clonidine	Rebound HTN	NEVER USE

Secondary Hypertension

Rather than attempt to impart all the nuances of the differential for secondary hypertension here, which would certainly be overwhelming, we introduce the topic and expect you to be able to identify someone who may have secondary hypertension.

Hypertension **before the age of 35** (though this has been challenged by the rise of childhood and early adult obesity) or any hypertension that's **refractory to 3 medications** where one is a diuretic should be considered for secondary causes. As the fourth medication is reached, alternative causes should be considered.

The most common secondary cause is **CKD / ESRD**. If the patient has this condition no workup need be done.

If they don't, then the tests to do and the order to do them in is dependent on the clinic picture. Assessing for clues in the history, physical, and typical labs guides where to start. The chart is included to the right for reference.

Conn's (primary hyperaldosteronism), pheochromocytoma, and **Cushing's** are discussed in the Endocrine: *Adrenals* lecture and are reviewed in *Surgical Hypertension* in the Surgery: Subspecialty series.

Renovascular hypertension and **aortic coarctation** are also discussed in *Surgical Hypertension* in the Surgery: Subspecialty series.

Class	*Examples*
CCB	Amlodipine, Felodipine
ACE	Lisinopril, Quinapril, Benazepril
ARB	Losartan, Valsartan
Thiazide	HCTZ, Chlorthalidone
Loop	Furosemide
β-blocker	Metoprolol, Carvedilol, Nebivolol
Art Dilators	Hydralazine
Venodilator	Isosorbide Dinitrate, Mononitrate
Aldo Antagonists	Spironolactone (gynecomastia) Eplerenone (no gynecomastia)

Type	*History*	*Workup*
Hyperaldo (1o Aldo)	Refractory HTN or HTN and HypoK	Aldo:Renin > 20 CT Pelvis
Hyperthyroid	Weight loss, Sweating, Heat intolerance, Palpitation,	TSH, Free T4
Hypercalcemia	Polyuria, AMS, "moans, groans, bones, kidney stones"	Free Ca
Aortic Coarctation	Children = warm arms, cold legs, claudication Adults = Rib notching, BP differential in legs and arms	X-ray of chest Angiogram, CT angio
Renovascular	DM or glomerulonephritis Young woman = FMD Old guy = RAS Renal Bruit, Hypo K	CrCl BMP Aldo:Renin < 10 U/S renal artery
Pheochrom-ocytoma	Pallor, Palpitations, Pain, Perspiration, Pressure	24-hr urinary metanephrines, CT
Cushing's	Diabetes, HTN, Central obesity, Moon Facies	Low-dose Dexa ACTH level High-dose Dexa
OSA	Obesity, daytime somnolence, improved with CPAP	Sleep Study